

Bacterium Identified as Prime Suspect in Zebra Chip Case

Since 2000, a mystery disease has struck some potato fields in Texas, Arizona, California, Nevada, and other western states, reducing tuber yields and quality. Losses have been estimated in the millions of dollars.

In response, scientists from ARS laboratories in Washington State, California, and Texas joined their state university colleagues to track down the cause of the disease, dubbed “zebra chip” (ZC). In 2007, an ARS-led team completed studies implicating the potato psyllid (*Bactericera cockerelli*) as an insect accomplice. In January 2008, New Zealand scientists—followed 7 months later by a University of California-Riverside team—announced their discovery of DNA evidence, coupled with investigative fieldwork, tying a new species of *Candidatus Liberibacter bacterium* to ZC in potatoes.

Throughout, growers had been spraying their crops with insecticides to prevent psyllids from transmitting ZC. But they didn’t know what actually caused the disease—only that it correlated to psyllid feeding. Now, with researchers building their case against the new *C. Liberibacter* species, growers have more information to go on. Confirmation of the bacterium’s ZC crimes will also create new opportunities for managing it.

For example, “If we know that the psyllids we get in area B each summer migrate in from area A, then we can test the population overwintering in area A to see if it’s infected. If it is, we can alert growers ahead of time,” explains Joseph E. Munyaneza, an entomologist with ARS’s Yakima Agricultural Research Laboratory in Wapato, Washington.

Predicting psyllid migration could also help time the use of natural enemies, including wasp parasitoids, insect-killing fungi, and ladybugs. Longer-term biological studies of the newly discovered *Candidatus* species will aid development of disease-resistant potato varieties.

ZC was first reported in Mexican potato fields in 1994 and in U.S. spuds in 2000 near Pearsall, Texas, and the Texas side

of the Lower Rio Grande Valley, where psyllids overwinter before migrating north each spring.

“Zebra chip” is so-named because afflicted tubers form dark, unsightly stripes when they’re cut and fried to make chips or fries—the result of soluble sugars being caramelized. This can also affect flavor. Eating such chips causes no harm, but growers feel the pain, economically speaking, when their harvest is rejected at the processing plant.

Since December 2007, Munyaneza, ARS plant pathologist James M. Crosslin, and ARS entomologist John Goolsby have conducted field experiments in Weslaco, Texas, to better understand the psyllid-*Candidatus* connection—and hopefully identify weak links to exploit. Of particular interest is determining why some psyllid populations transmit ZC and others don’t. One intriguing lead involves “vertical transmission”—whereby the bacterium is passed from female psyllids to their offspring.

The researchers’ studies also examined how altered planting dates may affect the severity of ZC. For example, 90 percent of potatoes planted in mid-December were infected with ZC by harvest in April, versus 25 to 30 percent of those planted in mid-January or mid-February and harvested in May. Munyaneza cautions it’s still too early to draw solid conclusions. “We need to understand why this is happening and repeat these same experiments,” he says.

Still, unmasking ZC’s identity has accelerated such research, leaving the disease with fewer avenues of escape.—
By **Jan Suszkiw**, ARS.

This research is part of Crop Protection and Quarantine, an ARS national program (#304) described on the World Wide Web at www.nps.ars.usda.gov.

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PEGGY GREB (D1524-1)



ARS plant pathologist James Crosslin removes a shoot from a zebra chip-infected potato for grafting to a healthy plant.

PEGGY GREB (D1525-1)



At the Yakima Agricultural Research Laboratory in Wapato, Washington, research associates Godfrey Miles, ARS, (left) and Venkatesan Sengoda, Washington State University, evaluate symptom severity in fried chips made from potatoes infected with zebra chip disease.